MATERIALS BUREAU

TECHNICAL REPORT 87-7

CRACKING AND SEATING PCC PAVEMENT CONSTRUCTION TECHNIQUES AND OVERLAY PERFORMANCE

FIRST INTERIM REPORT

DECEMBER, 1987

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NEW YORK STATE DEPARTMENT OF TRANSPORTATION
MARIO M. CUOMO, Governor
FRANKLIN E. WHITE, Commissioner

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ABSTRACT

This interim report summarizes a field investigation that was conducted to determine if changes in cracking and seating specifications made in 1983 were beneficial in reducing transverse reflection cracking of AC resurfacing over PCC pavement. The investigation involved monitoring eight cracking and seating contracts that used these specifications during the 1984-86 construction seasons. Reflection crack surveys were conducted thereafter. The conclusions drawn from this investigation to date are;

(1) All the cracking machines used during this investigation are capable of producing satisfactory crack patterns. However, there is a significant difference in efficiency between machines.

(2) All the machines could be operated safely except for the crane equipped with a wrecking ball.

(3) Reflection crack surveys show improved performance of AC overlays on PCC pavements cracked and seated under revised specifications.

(4) Sawcutting wire mesh reinforcement to improve AC overlay performance is an unproven technique to date; no difference in performance has been found within test areas thus far.

(5) Those portions of interchange ramps tied to mainline pavements should be included in cracking and seating operations.

Reflection crack surveys will be continued to provide AC overlay servicelife data for future cost analyses. Additional surveys will also be beneficial in determining;

(1) If the current rates of reflection cracking decrease, remain the same or increase with time,

(2) If sawcutting wire mesh reinforcement in underlying PCC pavement is a cost effective technique for increasing overlay performance with time,

(3) And, if D cracking in PCC pavement has an effect on the servicelife of AC resurfacings.

CONTENTS

BACKGROUND

Reflective cracks in asphalt concrete (AC) overlays develop primarily as a result of thermal contraction at joints and cracks in underlying Portland cement concrete (PCC) pavement panels. Most often, these cracks appear during the winter following overlay placement. This occurrence promotes further overlay deterioration and premature failure.

For over 20 years, New York's Engineering Research and Development Bureau researched methods of eliminating reflective cracking (Ref. 1-3). Methods investigated were;

(1) Placing heavy AC overlays to bridge underlying PCC joints and cracks,

(2) Placing wire mesh and fiber mesh reinforcement mats over underlying PCC joints and cracks to increase crack resistance in AC overlays,

(3) Placing a stone dust bond breaking blanket between the overlay and underlying PCC joints and cracks to extend the area of stress,

(4) Cracking (and seating) the PCC pavement before overlaying to distribute thermal contraction throughout the slabs,

(5) And, sawing (and sealing) joints in the AC overlay over underlying PCC pavement joints to control reflective cracking.

This research ruled out the use of methods 1 and 2 because of inconsistent results at increased cost. Method 3 was eliminated, simply because it was found to be ineffective. Conversely, methods 4 and 5 were found to be cost effective when done properly. Warrants for use, however, limited method 4 to only those pavements that were in an advanced state of deterioration, the others being method 5 candidates. The remainder of this report deals only with method 4, cracking and seating PCC pavements.

The conclusions reached by Research Engineers concerning cracking and seating were based on the successful use of this method in experimental test areas on two AC overlay contracts. On the first, completed in 1964, two 1000 ft. long areas were established. One area was cracked into, one ft. maximum sized fragments while the other was cracked into three to four ft. maximum sized pieces. Both were seated with a 50 ton roller before being overlayed with seven inches of AC. As far as could be determined, no specification was prepared for the contract, the test areas and associated details having been incorporated into the plans. On the second contract, completed in 1970, a variety of fragment sizes and overlay thicknesses were specified in nine 1000 ft. long test areas. The first generation specification used on this contract is presented in Appendix A (page A1-A2).

As the research results were implemented on additional contracts, a second generation of specifications were developed which are also presented in Appendix A (page A3 - A6).

In 1983, reflection cracks were reported in some relatively new overlays where the underlying PCC pavement had been cracked and seated. Since the overlays were already in place and no records were available concerning the type of equipment used, the resultant crack patterns that were developed and the extent and/or depth of cracking, it was impossible to pinpoint the cause of these occurrences. This prompted further investigation into the reliability of the method and adequacy of the specifications. Questions being asked were;

(1) Are there distinct differences in capability and/or efficiency between the various types of pavement breakers being used to develop crack patterns?

(2) What cracking patterns are being produced by the various types of breakers?

(3) Is the impact effort being restrained in an effort to minimize spalling since, in most cases, traffic has to be maintained over cracked and seated pavement prior to overlay placement and, if so;

(4) Is the PCC pavement being cracked full depth?

(5) Does welded wire mesh reinforcement hold cracked pavement panels so tightly together that they continue to act as whole panels?

SPECIFICATION DEVELOPMENT AND USE

Since little could be learned from the contracts that were reported to have developed reflective cracks, efforts were directed toward reviewing the research (Ref. 1-3) to determine why the test areas established in the research studies had performed so well. Although nothing definite could be determined, this review did disclose that positive full depth transverse crack patterns had been established using equipment that struck the pavement in a transverse arc. The second generation of specifications that evolved as a result of the research, however, failed to specify a similar crack pattern with similar equipment. This led to the development of the third generation specification that appears in Appendix A (page A7-A8) which superseded the previous specifications for all cracking and seating contracts scheduled for the 1984 construction season. This specification contained a provision not included in the others. It required that a test section be designated by the Engineer in which the Contractor had to demonstrate that the cracking equipment was capable of producing a specified full depth transverse crack pattern without excessive displacement or spalling. Once achieved to the satisfaction of the Engineer, the Contractor was then allowed to crack the remainder of the pavement on the contract.

This specification was incorporated into the plans for four Department contracts in 1984. However, it was only used on one after it was discovered that impacts too close to the free edge (shoulder edge) caused excessive spalling of that edge. Also, it was found that if each transverse cracking pass began at the free edge and progressed to the centerline, a better crack pattern was produced than if the equipment was allowed to crack from the edge to the centerline and then back to the edge. What was learned in the field on the first contract was used to develop the fourth generation specification in Appendix A (page A9-A10). The remaining three contracts previously mentioned plus four others were built in accordance with this specification during the 1985 and 86 construction seasons.

To determine if the presence of welded wire mesh reinforcement in the pavement was nullifying the cracking and seating effort, an additional test area was established on one of the eight contracts in which the mesh was severed every 20 feet by transverse saw cuts, before the cracking and seating operation. The specification used for this is presented in Appendix A (page A11). The locations of the eight contracts studied are shown in Figure 1. TABLE 1 contains additional information concerning these contracts and the study that ensued.

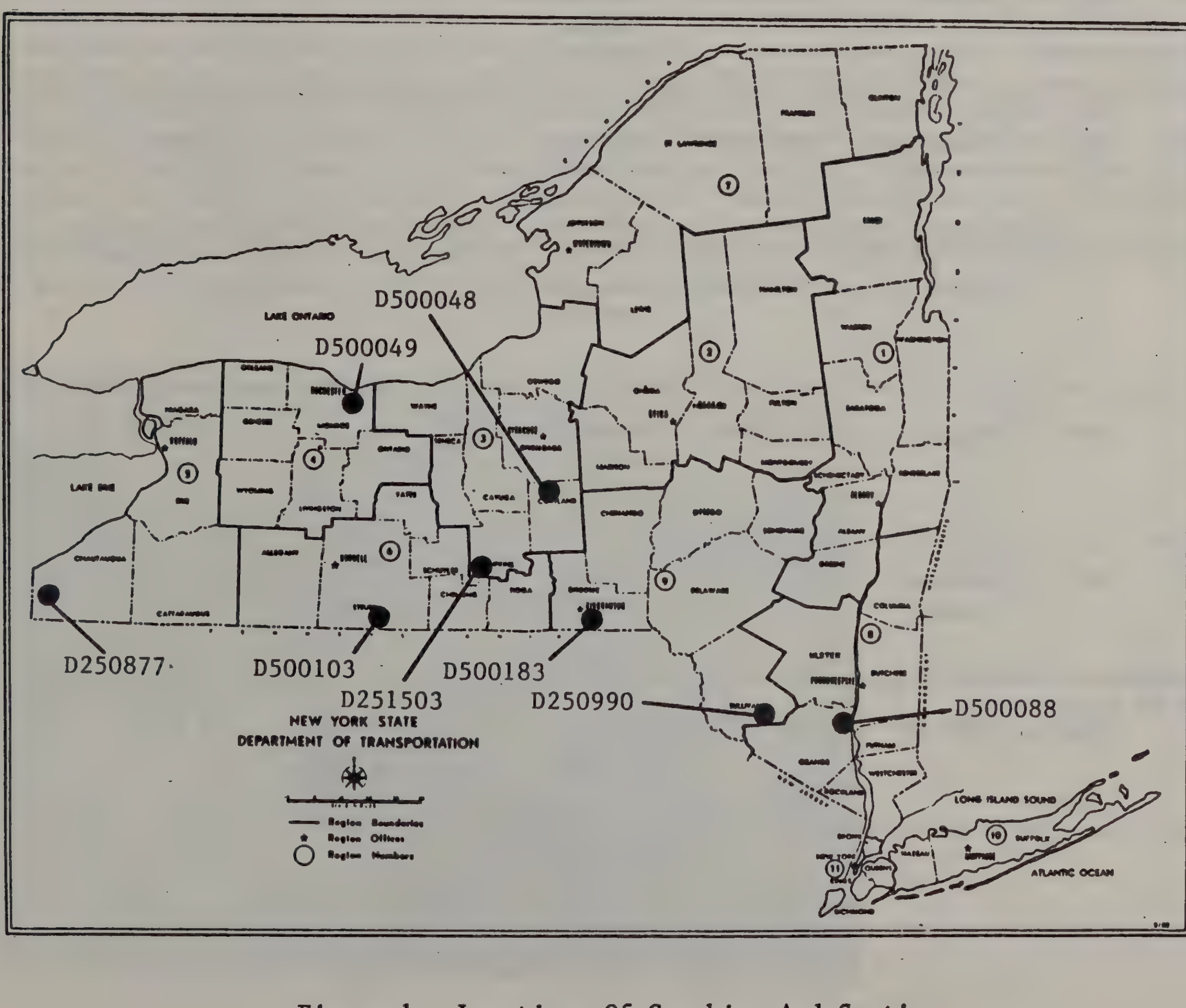

Figure 1 - Locations Of Cracking And Seating Contracts Studied

TABLE 1 - Cracking And Seating Contracts Under Study

Contract Number	Location Rte. No.	County	Specification(s) Used	Equipment Used	Total Lane Miles Cracked & Seated	Total Overlay Thickness (In.)	Year Completed
D250877	60	Chautauqua	18203.99	Drop Hammer	14.4	6 1/2 (+T&L)	1984
D250990	17	Sullivan	18203.9901	Wrecking Ball	5.9	5 Min.	1985
D500103	15	Steuben	18203.9901	Whiphammer & Wirtgen CB7000	8.1	5 1/2	1985
D500048	I81	Onondaga & Cortland	18203.9901	Wirtgen CB7000	43.1	5 Min.	1985
D500183	17	Broome	18203.9901	Wirtgen CB7000	1	6	1985 (EB)
D500049*	I590	Monroe	18203.9901	Wirtgen CB7000	7.5	5 (+T&L)	1985
D500088	I84	Dutchess & Orange	18203.9901	Wirtgen CB7000	1.5	6	1986
D251503	13	Tompkins	18203.9901	Wirtgen CB7000	8	5 (+T&L)	1986

*Some slabs on this contract were sawcut at 20 ft. intervals to sever welded wire mesh reinforcement.

Route 60 (D250877)

This two lane PCC highway was originally built during the 1956 & 57 construction seasons, with 100 ft. long, mesh reinforced panels separated by transverse expansion joints. It is classified as a rural principal arterial (other) with an AADT of 4,800-5,800, 16% of which are trucks. Since construction and prior to its rehabilitation in 1984, only routine maintenance had been performed by state forces. By 1984, the existing pavement contained numerous, faulted panel cracks and the transverse joints were spalled, crushed and patched. Much of this distress was blamed on an absorptive slag that was used as coarse aggregate when the pavement was constructed. Over the years, however, the infiltration of incompressible material and water into inadequately sealed joints and cracks also contributed to the pavement's deteriorated state. For these reasons, it was decided to crack and seat the pavement before resurfacing it with AC.

A drop hammer was used to crack the pavement in the designated test area on the contract (Figure 2). One lane was cracked while traffic was being maintained in the other. The pavement breaker was a self propelled unit which dropped a 1200 pound weight from a 4 ft. height. The energy produced was transmitted through a 4 1/2 inch diameter breaking head attached to the bottom of the weight. The operator had the capability of moving the weight across the back of the machine. However, this capability was limited, and a second pass was required in each lane to complete the specified transverse striking pattern. Soon after the contractor began cracking the pavement in the test area, it was discovered that a more desirable crack pattern was easier to achieve if the initial pass began at the unsupported (shoulder) edge and progressed toward the longitudinal joint between lanes rather than beginning near the center of the lane (as shown in Figure 2) or at the longitudinal joint and progressing toward the unsupported edge. It was also found that striking the pavement six inches from the unsupported edge, as specified, often spalled the edge instead of initiating a crack. These experiences led to changes on this project and specification revisions that corrected these inadequacies. The fourth generation specification that evolved appears in Appendix A, (page A9-A10). It was used on the seven other contracts rehabilitated in 1985 and 86.

Figure 2 - Drop Hammer Used On Rte. 60 (D250877)

The crack pattern developed by the drop hammer was different than expected. It was thought that positive transverse cracks would initially develop in line with the transverse striking pattern of the machine and that longitudinal cracks would develop as additional transverse striking passes were completed. In most instances, however, just the opposite occurred, with either longitudinal or diagonal cracking occurring first. As cracking continued these cracks linked up to produce irregular transverse cracks. The end result was a crack pattern resembling map cracking (Figure 3). Although the sequence of crack development was not anticipated, definite transverse cracks eventually developed as evidenced by full depth cores (Figure 4). Therefore, the pattern was considered satisfactory and the contractor was allowed to proceed on the remainder of the contract.

Figure 3 - Crack Pattern Achieved With The Drop Hammer

Figure 4 - Core Taken To Verify Full Depth Transverse Cracking
On Rte. 60 (D250877)

The production rate of the drop hammer on this contract was approximately 0.76 lane miles per day which was slower than the normal paving rate. Consequently, three additional drop hammers were pressed into service to complete cracking. Because of breakdowns, however, only three machines were usually working at a time. Paving was completed before the end of the 1984 construction season.

Route 17 (D250990)

This four lane divided PCC highway was built during the 1956 and 57 construction seasons, with 100 ft. long, mesh reinforced panels separated by transverse expansion joints. Sometime later, a third lane was added in the eastbound direction which was constructed with 50 ft. long, mesh reinforced panels separated with transverse contraction joints. The highway is classified as a rural principal arterial (other) with an AADT of approximately 14,000, 6% of which are trucks. Since construction and prior to its rehabilitation in 1985, only routine maintenance had been performed by state forces. By 1985, the pavement contained numerous faulted panel cracks and blowups which prompted the decision to crack and seat the panels prior to resurfacing with AC.

The designated test area on this contract was in the eastbound lanes where a crane equipped with a wrecking ball was used to crack two lanes while traffic was being maintained in the third (Figure 5).

Figure 5 - Crane Equipped With Wrecking Ball Used On Rte. 17 (D250990)

The ability of this equipment to develop the specified striking pattern was solely dependent on the skill and persistence of the equipment's operator in controlling the drop height, orientation, swing and roll of the wrecking ball. This was especially critical when the operator was cracking near the lane being used by traffic. To further complicate this, it was more difficult to satisfactorily crack the center lane which, of course, was supported on either side by the other lanes.

Crack development with this equipment was similar to that on the Rte. 60 contract, longitudinal and/or diagonal cracks appearing before transverse cracking. This resulted in a diamond shaped pattern resembling a chain link fence (Figure 6). As before, this pattern was not what was originally expected but was considered satisfactory since definite irregular transverse cracks eventually developed as evidenced by full depth cores.

Despite an extremely low production rate in the designated test area, the contractor continued to use the wrecking ball to crack panels. Apparently, the speed at which the pavement was cracked on this particular contract was not critical. Cracking resulted in minor spalling and some patching was needed to maintain the pavement surface for traffic before the AC overlay was placed. Paving was completed before the end of the construction season.

Figure 6 - Cracking Pattern Achieved With The Wrecking Ball

Route 15 (D500103)

This two lane PCC highway was built during the 1952-54 construction seasons, with 90 ft. long, mesh reinforced panels separated by transverse expansion joints. It is classified as a rural minor arterial with an AADT of approximately 4,500, 20% of which are trucks. Since construction and prior to its rehabilitation in 1985, only routine maintenance had been performed by state forces. By 1985, the existing pavement was severely D cracked at transverse and longitudinal joints as well as at numerous faulted transverse panel cracks. D cracking was also responsible for the spalling that had occurred at these locations. This distress form is generally associated with the use of absorptive coarse aggregate in the concrete matrix. Because of these existing deficiencies the decision was made to crack and seat the pavement before resurfacing it with an AC overlay.

On this highway, one lane was cracked while traffic was maintained in the other. Initially, the contractor opted to use a Whiphammer to crack the pavement in the designated test area (Figure 7). The Whiphammer is a flexible arm made up of leaf springs with a flat, 1 ft. square, cracking head attached to one end. The other end is attached to the back of a truck where the arm is hydraulically raised to its striking position. In addition, the operator can swing the arm in a 7 ft. long transverse arc across a pavement lane. Consequently, two passes are required to complete the specified transverse striking pattern (Figure 8). The Whiphammer strikes the pavement in much the same way an individual would strike a surface with a hand held hammer.

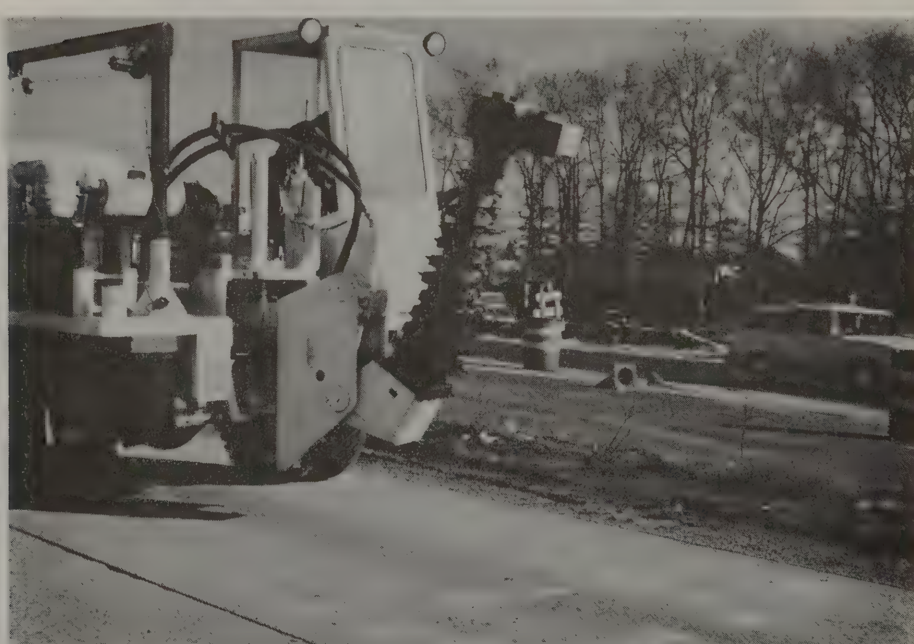

Figure 7 - The Whiphammer Pavement Breaker Similar To That Used On Rte. 15 (D500103)

Figure 8 - Resultant Strike Pattern After Second Whiphammer Pass

One day was spent unsuccessfully attempting to establish an acceptable crack pattern in the contract's designated test area. Efforts involved the use of three different breaking heads; a worn, foot square steel flat head, a new, foot square steel flat head and a new, foot square steel flat head with a 4 in. X 12 in. steel bar welded to its striking surface which reduced the striking area of the head to the dimensions of the bar. The first two heads were not capable of developing the specified crack pattern. With the third, results were inconsistent. On the second day of cracking the bar on the bottom of the third head was reduced further to 2 in. X 12 in. (Figure 9). This modification produced a satisfactory pattern provided the breaking procedure outlined in the specification was stringently followed. On the third day, however, results were again inconsistent and operations were suspended. Consequently, it was not possible to establish a production rate for this machine.

Figure 9 - Whiphammer Breaking Head With Attached Bar

In order to progress the contract, the contractor acquired a Wirtgen CB7000 pavement breaker to replace the Whiphammer (Figure 10). This self propelled machine is equipped with a 7 ton, 4 in. X 67 in. guillotine type drop weight which is winched to its striking position and released as the machine is driven at approximately 1 mile/hr. in the lane being cracked. At this speed the weight strikes the pavement every 20-30 inches.

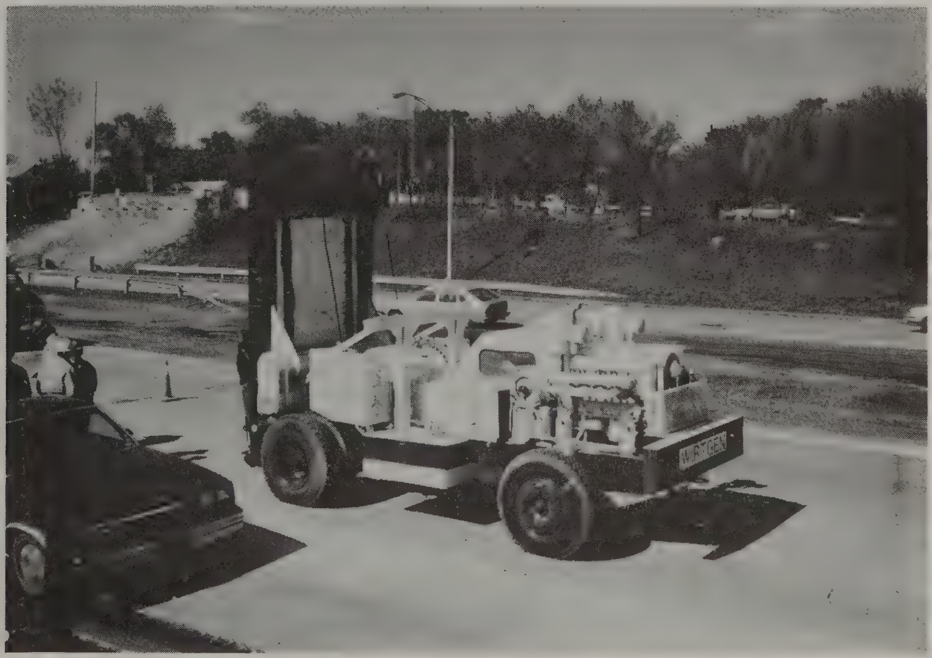

Figure 10 - The Wirtgen CB7000 Pavement Breaker
(Photo taken on the I590 contract)

Using this machine, a satisfactory crack pattern was developed in each lane with a single pass and a drop height of 34 in. A second pass (which according to the specification was required) was not made to avoid overbreaking. As a result, the machine was capable of cracking almost a lane mile per hour which far exceeded the production rate of any other pavement breaker evaluated.

As before, longitudinal and diagonal cracking developed before transverse cracking which, for the most part, resulted in a diamond shaped crack pattern (Figure 11). However, with this machine, there were instances where transverse cracks occurred immediately. Positive full depth transverse cracking was verified by cores.

Figure 11 - Crack Pattern Developed By The Wirtgen CB7000 On Rte. 15 (D500103)

Spalling, resulting from cracking, was minimal except where the weight was allowed to fall directly on a previously damaged or delaminated transverse joint. Minor spalling also occurred on superelevated curves where only one corner of the weight struck the pavement rather than the entire striking surface of the weight (Figure 12). The rest of the pavement on this contract was cracked with the Wirtgen machine and paving was completed before the end of the construction season.

Figure 12 - Minor Spalling That Occurred On Superelevated Curves

I81 (D500048)

This four lane divided PCC highway was built during the 1963-66 construction seasons, with 60 ft. long, mesh reinforced panels separated by transverse contraction joints. It is classified as a rural principal arterial interstate with an AADT of approximately 15,000, 10% of which are trucks. Since construction and prior to its rehabilitation in 1985, only routine maintenance had been performed by state forces. By 1985, the existing pavement joints were severely deteriorated as a result of D cracking. In addition, the transverse joints were faulted because of corroded load transfer devices and many panels contained transverse cracks. For these reasons, the pavement was cracked and seated before being resurfaced with AC.

The Wirtgen CB7000 was also used to crack the pavement on this contract. As before, one lane was cracked while traffic was maintained in the adjacent lane. The method of cracking, performance and production rate of the machine and the resulting crack pattern achieved were the same as was experienced on the Route 15 (D500103) contract previously discussed. Therefore, these details will not be repeated here.

Cores were taken to verify full depth transverse cracking. In doing this, however, it was discovered that, in addition to vertical cracking, existing delaminations from D cracking were being aggravated. This caused some concern, since most delaminations are in a horizontal plane at mesh level 3 to 4 inches from the surface which, when loosened, could lead to premature localized overlay failure. On the other hand, the cracking operation could prove beneficial in locating delaminated areas which were not previously discernable. In either case, more concrete removal and patching may be required on pavements deteriorated from D cracking rather than from other forms of distress (Figure 13).

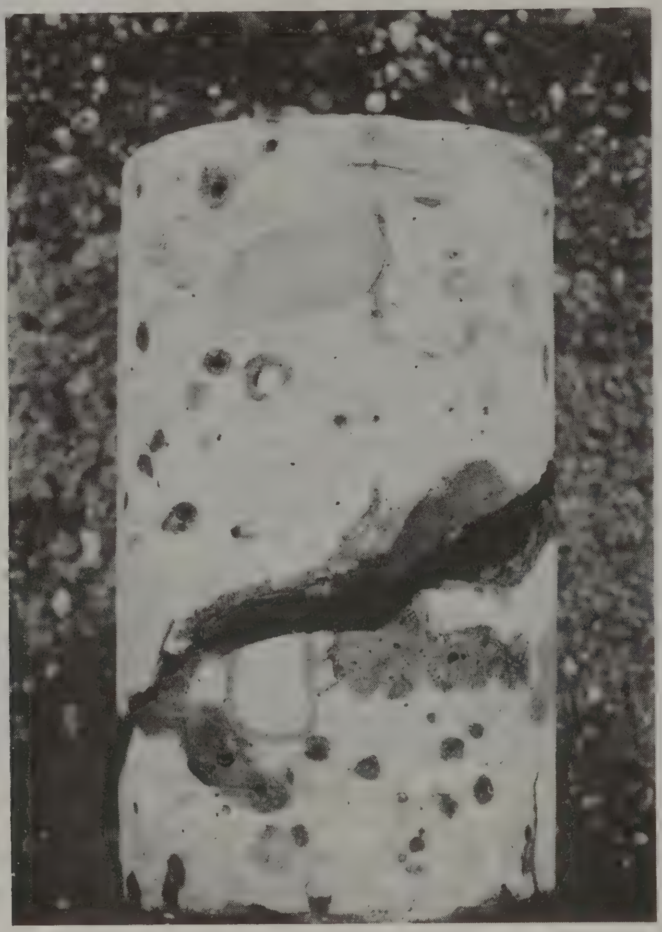

Figure 13 - Verification Core Revealing Delamination Crack Aggravated By The Cracking Operation On I81 (D500048)

In the third and fourth generation cracking and seating specifications, written since 1983, it states that "Subsequent asphalt concrete bottom course pavement construction on this cracked and seated concrete pavement shall be placed within two weeks of the completion of the cracking and seating operation." This specified time limit is a compromise between giving the contractor sufficient time to place the initial overlay course while, at the same time, limiting the inconvenience to traffic using the cracked and seated pavement prior to overlayment. Normally, this requirement is not difficult for a contractor to achieve as most asphalt overlay projects are relatively short. However, in this case, the length of the contract combined with the production rate of the Wirtgen CB7000 did create some scheduling difficulties. Paving was completed before the end of the construction season.

Route 17 (D500183)

This four lane divided PCC highway was built during the 1960-62 construction seasons, with 60 ft. long, mesh reinforced panels separated by transverse contraction joints. It is classified as a rural principal arterial (other) with an AADT of 9,400, 6% of which are trucks. Since construction and prior to its rehabilitation in 1985-86, only routine maintenance had been performed by state forces. By 1985, both the transverse and longitudinal joints were separated, faulted and extensively spalled, most spalls having been patched by maintenance personnel. In addition, there were numerous panels that contained transverse cracks. Other deficiencies included moderate wheel rutting and popouts in the surface which indicated that some of the large aggregate used during construction was of the absorptive variety. Prior to rehabilitation, however, only one pavement blowup had occurred.

Since most of the pavement deterioration had developed in the immediate vicinity of the longitudinal and transverse joints, it was decided to crack and seat (full pavement width) only those areas on the contract where the pavement panels were extensively cracked. The design called for increasing overlay thickness from 4 1/2 in. to 6 in. by means of transitions either side of these areas.

As previously mentioned, both the cracking and seating method and sawing and sealing method have been used independently to control reflective cracking, the cracking and seating method being used on the more severely distressed pavements. On this contract, however, the AC resurfacing was sawed and sealed over underlying transverse PCC pavement joints even in the cracked and seated areas. Although the use of both methods appears redundant, the designers specified both because of inconsistent results on some past cracked and seated resurfacing contracts.

The Wirtgen CB7000 was also used to crack the PCC panels in the eastbound lanes of this contract with results similar to those reported previously. Cores taken to verify full depth cracking revealed the presence of delaminatious cracks. Some of the spalling that occurred at transverse joints during cracking was believed to be associated with the presence of these cracks (Figure 14). Spalls had to be repaired with AC before the initial AC overlay course was placed. The eastbound lanes were overlayed before the end of the 1985 construction season. The westbound lanes were not cracked, seated and overlayed until 1986. At that time, a drop hammer was used to crack panels. Since representatives from the Materials Bureau were not present to observe this operation, further evaluation of the westbound lanes was discontinued.

Figure 14 - Spalling At A Transverse Joint Believed To Be Associated With Delamination Cracks

I84 (D500088)

This four lane divided PCC highway was built during the 1962-63 construction seasons, with 60 ft. long, mesh reinforced panels separated by transverse contraction joints. It is classified as an urban principal arterial interstate with an AADT of 25,000-35,000, 6% of which are trucks. In 1984, the severely faulted transverse joints and panel cracks on this contract were diamond ground to temporarily improve the pavement's rideability. At that time, however, nothing was done to restore load transfer and prevent the recurrence of faulting. Prior to 1984, only routine maintenance patching had been done at badly spalled transverse joints. Because of the above cited distress, it was decided to crack and seat the pavement before overlaying it with AC.

Cracking was done with the Wirtgen CB 7000 in the fall of 1985, the results being the same as had been achieved on previous contracts. As before, one lane was broken while traffic was maintained in an adjacent lane. The pavement, however, was only overlayed with 3 inches of AC Type 1 base course before the construction season ended and traffic was allowed on it over the winter months. The remaining 3 inches of AC, consisting of 1 1/2 inches of Type 3 binder and 1 1/2 inches of Type 7F top, were placed the following year.

I590 (D500049)

This four lane divided PCC highway was built during the 1964-66 construction seasons, with 60 ft. long, mesh reinforced panels separated by transverse contraction joints. It is classified as an urban principal arterial interstate with an AADT of 40,000-50,000, 5% of which are trucks. Since construction and prior to its rehabilitation in 1985, only routine maintenance had been performed by state forces. By 1985, most transverse joints were faulted and load transfer had been lost. Also, numerous panel cracks had developed and full depth AC repairs had been made at frequent blowups. For these reasons, it was decided to crack and seat the existing PCC pavement before resurfacing it with AC.

Prior to the initiation of this investigation, attempts to eliminate or at least retard reflective cracking in AC overlays by cracking and seating PCC pavements beforehand, had varied considerably. In the worse cases, cracking and seating appeared to have no effect, reflective cracks developing in the overlays over underlying PCC transverse joints during the winter following overlay placement. As stated previously, the reason for these occurrences was not discernable. However, it was thought that either the panels were not being cracked full depth or that the wire mesh reinforcement was discouraging thermal expansion and contraction at induced cracks and movement was continuing to occur only at transverse joints. On this contract, a test area almost 4 lane miles in length was established to test the latter supposition. In this area, 1/8 in. wide transverse cuts at 20 ft. intervals were sawn in the 60 ft. long PCC panels. These cuts were of sufficient depth to sever the mesh (about 4 in.). The panels were then cracked and seated in accordance with the specification, as they were on the rest of the contract. No attempt was made to strike the pavement directly over the sawcuts to induce cracking below the cuts.

The pavement was cracked a lane at a time with the Wirtgen CB7000, traffic being maintained in the adjacent lane. The crack pattern and production rate achieved was the same as had been experienced on previous contracts. Cores were taken to verify full depth cracking and to determine if the saw cuts in the test area had severed the reinforcement. It was found that both had been accomplished (Figure 15). The cores, however, did indicate the presence of D cracking even though this was not readily evident at the surface (i.e. popouts, spalling and/or dark staining at joints and cracks). Full depth cracks were angled rather than vertical because of existing delaminations within the concrete.

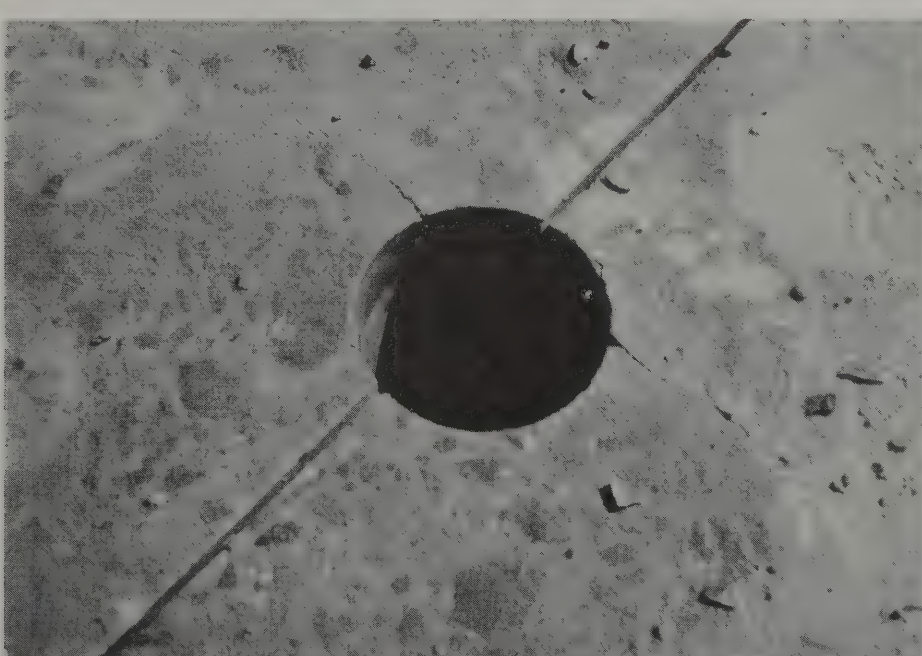

Figure 15 - Core Hole Revealing That Mesh Had Been Severed And Pavement Had Been Cracked Full Depth.

Route 13 (D251503)

This two lane PCC highway was built about 1960, with 25 ft. long, unreinforced panels separated by transverse contraction joints. It is classified as a rural principal arterial (other) with an AADT of 4,600-4,800, 8% of which are trucks. Since construction and prior to its rehabilitation, only routine maintenance had been performed by state forces.

By 1985, extensive D cracking and spalling had occurred at transverse and longitudinal joints and at numerous panel cracks. These conditions had adversely affected the pavement's rideability. Consequently, it was decided to crack and seat the pavement before resurfacing it with AC.

The Wirtgen CB 7000 was used to crack the pavement on this contract. One lane was cracked while traffic was maintained in the other. In 1985, only 5.6 lane miles (2 adjacent lanes, 2.8 lane miles long) were cracked because the operation was not begun until late in the paving season. This mileage was overlayed with an inch of T&L and 3 1/2 inches of binder except for the last 4,000 ft. on the southern end of the contract where only T&L was placed before paving was suspended for the season. The remaining 2.4 lane miles were cracked and seated and paving was completed on the entire contract in 1986.

As previously mentioned, the more recent cracking and seating specifications were written in anticipation that positive transverse cracking would be achieved and longitudinal cracking would develop as cracking progressed. However, experience on all the previously discussed contracts showed that, more often, longitudinal and/or diagonal cracking occurred first and as cracking continued transverse cracks developed creating a diamond shaped crack pattern. It was believed that pattern development was being influenced by the presence of wire mesh reinforcement in the panels. This could not be substantiated on this contract, however, for when the unreinforced panels were cracked, the same crack sequence and diamond shaped pattern were again achieved.

Cores, once again, indicated that vertical crack development in D cracked pavement is difficult to achieve. More often, full depth cracks are angled, following the path of delamination cracks.

RESULTS OF FIELD OBSERVATIONS

Cracking Equipment - Capability And Efficiency

All of the machines used to crack the PCC pavement on the eight rehabilitation contracts were capable of producing full depth transverse crack patterns without excessive surface spalling or fragment displacement (except for the whiphammer which, most likely, could produce an acceptable pattern if its striking head were redesigned). However, there was a distinct difference in efficiency between the various machines.

To conform to specification requirements, it was necessary for the drop hammer (used on Rte. 60) to strike the pavement numerous times in two passes. This was time consuming and, as a result, one machine could crack only 3/4 of a lane mile per day. A similar rate was experienced with the wrecking ball (used on one of the Rte. 17 projects) even though a full width pavement lane could be cracked in a single pass. No production rate could be established for the Whiphammer. In contrast, the Wirtgen CB 7000 was able to crack a lane mile within an hour, once it was found that the specified crack pattern could be produced in a single pass down the centerline of the pavement. To conform to specification requirements would have required side by side passes with this machine. However, this requirement was waived to prevent the possibility of overbreaking and subsequent spalling of the surface.

Equipment Safety

All of the machines could be operated safely while traffic was being maintained in an adjacent lane except for the wrecking ball. It was obvious that the operator of this machine was having difficulty controlling the swing and roll of the ball. Although no incidents occurred on the contract where it was used, it was felt that the operation was potentially dangerous and should not be attempted on future contracts.

Crack Patterns

If cracking was done in accordance with the procedure outlined in the specification, it was anticipated that straight, full depth transverse cracks would be achieved. In practice, however, this was not the case. Instead, longitudinal and/or diagonal cracks appeared first regardless of the equipment used. As cracking continued, these longitudinal and diagonal cracks linked up to form saw toothed shaped transverse cracks and diamond shaped crack patterns.

Effect Of Mesh Reinforcement

The development of diamond shaped crack patterns rather than straight transverse cracks was initially perceived to be related to the presence of welded wire mesh reinforcement in PCC pavement panels. This, assumption, however, proved to be unfounded when the same diamond shaped pattern resulted on an unreinforced pavement that was cracked during this investigation.

Sequence Of Operations

On some contracts, the cracking and seating operations aggravated existing delamination cracks not previously discernable. This caused some additional spalling. In some instances AC spall patches previously placed had to be repaired. To avoid this, spall patching should be done after the cracking and seating operation is completed.

FOLLOWUP CRACK SURVEYS

Reflective crack surveys were conducted on the eight previously described projects after rehabilitation work was completed in order to answer remaining questions being asked when this investigation was initiated. Each of the eight being monitored was surveyed periodically to record the actual number of reflective cracks that had developed in the overlays. From this data, a ratio between actual reflective cracking and probable reflective cracking was established and is expressed as a percent in TABLE 2 following this discussion. Probable reflection cracking was determined by assuming that reflective cracks would develop over every existing transverse pavement joint within a year, had the pavement not been cracked and seated prior to overlay placement. This assumption is based on past experience with 60 ft. and longer PCC pavement slabs that were not cracked and seated prior to being overlayed with AC. (The assumption may not be valid for the Rte. 13 contract where the original slab lengths were only 25 ft.) Existing PCC slab cracks were not included in calculating probable reflective cracking as their numbers on each contract would have to be known and this information was not available. As a result, the probable reflection cracking criteria is considered conservative, since reflection cracks also occur over underlying slab cracks that are effected by thermal contraction.

TABLE 2 - Percent (Actual/Probable) Of Reflective Cracks
That Have Occurred Since Rehabilitation

Contract Number	Route Number	County	Date Overlayed	1st Survey %	1st Survey Time In Months	2nd Survey %	2nd Survey Time In Months	3rd Survey %	3rd Survey Time In Months
D250877	60	Chatauqua	June '84	7	15	8	20	10	38
D250990	17	Sullivan	April '85	0	9	0	24		
D500103	15	Steuben	April '85	1	10	1.5	24		
D500048	I81	Onondaga & Cortland	May '85	1	8	1	25		
D500183	17	Broome	June '85	0	6	0	22		
D500049	I590	Monroe	May '85	0	9	0	22		
D500049*	I590	Monroe	May '85	0	9	0	22		
D500088	I84	Dutchess & Orange	October '85	0	1	0	4	0	22
D251503	13	Tompkins	October '85	0	4	0	20		
D251503	13	Tompkins	May '86	0	13				

*That portion of the I590 contract where PCC pavement panels were transversely sawed at 20 ft. intervals to sever welded wire mesh reinforcement.

RESULTS OF FOLLOWUP CRACK SURVEYS

As can be seen from TABLE 2, no reflective cracks had developed on five of the contracts 13 to 24 months after overlay placement. Less than 2% of the transverse joints have reflected through on 2 other contracts since they were rehabilitated 24 months ago and 10% of the transverse joints had reflected through the overlay on the oldest contract which was completed 38 months ago. This represents a significant reduction in the incidence of reflection cracking from that experienced prior to the 1983 specification changes.

To date, data accumulated on the I590 (D500049) contract shows no difference in overlay performance over those PCC panels that were sawed at 20 ft. intervals and those that were not, no transverse reflection cracking having occurred in either case.

ADDITIONAL OBSERVATIONS DURING CRACK SURVEYS

Most of the transverse reflection cracks that have developed since overlay placement appear to be located over underlying PCC joints. They appear randomly, are singular (no secondary cracking has occurred), and are not as wide as those commonly found in overlays where the underlying concrete has not been cracked and seated (Figure 16). Other reflection cracks have occurred over previously "working" panel cracks which may or may not be over underlying cross culverts. Also, there is no indication, to date, that overlays placed on D cracked delaminated pavement perform any differently than those placed on PCC pavement not exhibiting this form of distress.

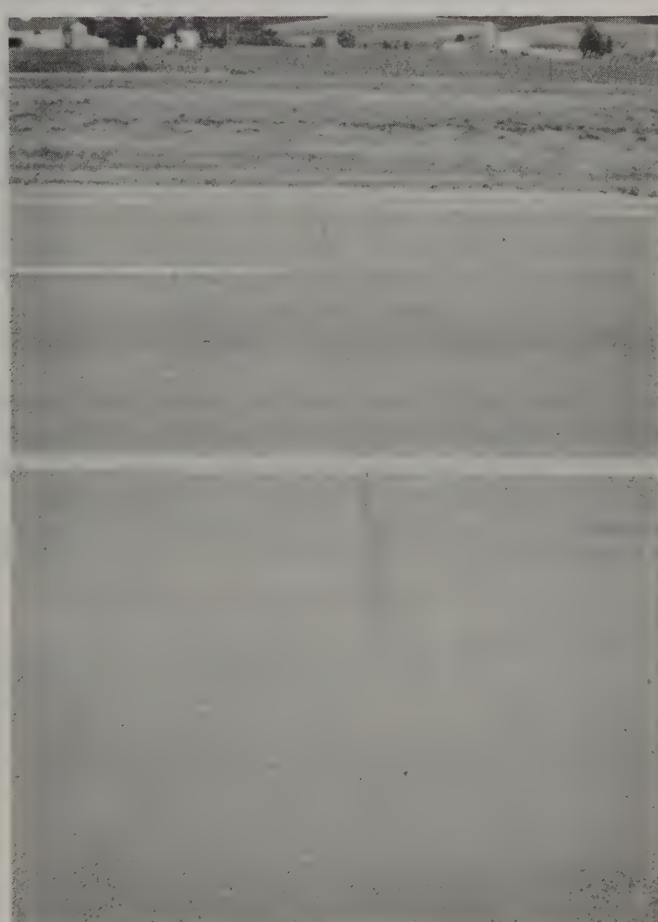

Figure 16 - Typical Reflection Crack That Has Developed Over An Underlying PCC Pavement Joint Since Overlay Placement

The only other overlay distress observed to date was found on the Rte. 17 (D250990) contract, during the second survey, 24 months after overlay placement. This distress consisted of short (approx. 2 ft. long) cracks, 1 to 2 ft. in from the outside pavement/shoulder joint. They were found at seven locations and appear to have developed over edge spalls that most likely occurred during the cracking operation (Figure 17).

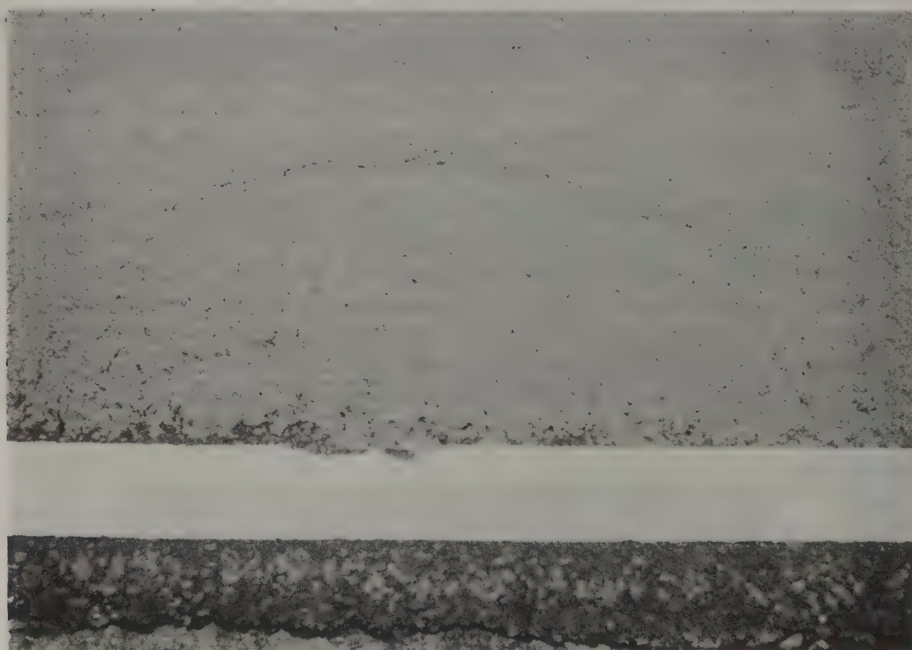

Figure 17 - Typical Short Reflection Crack
Near Pavement Edge

Finally, the following observation was made on those contracts containing interchanges where the mainline pavement had been cracked and seated but the abutting acceleration and deceleration ramps had not. In these instances, transverse reflective cracks have developed over underlying joints in the ramps but not over mainline joints.

PRESENT STATUS

As a result of what had been learned from the preceding investigation, the cracking and seating specification was changed once again. This fifth generation specification, which is currently in effect, is presented in Appendix A (page A12-A13). It differs from those used during the investigation in that;

(1) Verification of full depth cracking by coring is now included as part of the specification,

(2) The application of a fine water spray following the cracking operation has been included for enhancing crack location,

(3) Unconfined, free falling weights (i.e. wrecking balls) will no longer be allowed to crack PCC pavement on future contracts,

(4) Different striking patterns for various types of cracking equipment are specified,

(5) Provisions for protecting passing traffic from flying debris has been included,

(6) The sequence of operations portion of the specification has been modified to insure that cracking and seating precedes AC spall patching and,

(7) A minimum of 3 1/2 in. of AC resurfacing is now required over cracked and seated pavement before paving ceases for the winter.

CONCLUSIONS

Based on field observations and followup reflection crack survey data, the following conclusions have been drawn from this investigation;

(1) All the cracking machines used during this investigation are capable of producing satisfactory crack patterns. However, there is a significant difference in efficiency between machines.

(2) All the machines could be operated safely except for the crane equipped with a wrecking ball.

(3) Reflection crack surveys show improved performance of AC overlays on PCC pavements cracked and seated under revised specifications.

(4) Sawcutting wire mesh reinforcement to improve AC overlay performance is an unproven technique to date; no difference in performance has been found within test areas thus far.

(5) Those portions of interchange ramps tied to mainline pavements should be included in cracking and seating operations.

FUTURE PLANS

Reflection crack surveys will be continued to provide AC overlay servicelife data for future cost analyses. Additional surveys will also be beneficial in determining;

(1) If the current rates of reflection cracking decrease, remain the same or increase with time,

(2) If sawcutting wire mesh reinforcement in underlying PCC pavement is a cost effective technique for increasing overlay performance with time,

(3) And, if D cracking in PCC pavement has an effect on the servcelife of AC resurfacings.

REFERENCES

(1) Reflection Cracking Of Bituminous Overlays On Rigid Pavements, Special Report 16, Engineering Research and Development Bureau, NYSDOT, February 1973.

(2) Reduction Of Reflection Cracking In Bituminous Overlays On Rigid Pavements, Research Report 80, Engineering Research and Development Bureau, NYSDOT, June 1980.

(3) Reflection Cracking In Bituminous Overlays On Rigid Pavements, Research Report 109, Engineering Research and Development Bureau, NYSDOT, October 1983.

APPENDIX A

ITEM 2PB3-8 PAVEMENT BREAKUP (3' Max. Diam.)

1. Description:

   Under this item the contractor shall breakup existing concrete pavement with a pavement breaker, wrecking ball or other suitable device.

2. Construction Details:

   All the pavement segments shall have a maximum dimension of three feet.

   Upon completion of the breaking operation the pavement shall be swept clean of all loose surface fragments. After the pavement has been swept clean of loose fragments, the pavement shall be rolled with a pneumatic tired roller or a comparable roller as described in paragraph "J" under excavation, Section 8b, in the Public Work's Specifications of January 2, 1962, and approved by the Engineer-in-Charge. Rolling shall be continued until the pieces of pavement are seated in the existing subbase. The period of rolling shall be determined by the Engineer-in-Charge.

   Upon completion of this operation, for the purpose of leveling and maintaining traffic, a 1"± course of Item 51TL, Asphalt Concrete Truing and Leveling Course, shall be placed immediately upon the broken pavement.

3. Method of Measurement:

   The quantity of broken pavement to be paid for under this item will be the number of square yards broken in accordance with this specification. The payment limits of the breakup shall not exceed those locations shown on the plans unless otherwise ordered by the Engineer.

4. Basis of Payment:

   The unit price bid per square yard for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that the truing and leveling course necessary shall be paid for under Item 51TL. No direct payment will be made for cleaning and rolling the existing pavement; the cost of which shall be included in the price bid for this item.

ITEM 2PB6-8 PAVEMENT BREAKUP (6' Max. Diam.)

The specifications for Item 2PB3-8 shall apply except that under this item the contractor shall breakup the existing concrete pavement into segments having a maximum dimension of six feet.

ITEM 2PB10-8 PAVEMENT BREAKUP (10' Max. Diam.)

The specifications for Item 2PB3-8 shall apply except that under this item the contractor shall breakup the existing concrete pavement into segments having a maximum dimension of ten feet.

SPECIAL NOTE

CONSTRUCTION PROCEDURE

The contractor shall breakup various 1000 feet test sections of 20 foot concrete pavement into maximum sized segments as indicated. Upon completion of the breaking operation the pavement will be swept clean of loose fragments and the pavement rolled with a rubber tired roller. Rolling shall be continued until the pieces of pavement are seated into the existing subbase. Upon completion of this operation for the purpose of leveling and maintaining traffic, a 1" course of Item 51TL Asphalt Concrete Truing and Leveling Course will be placed immediately upon the broken pavement.

The existing shoulder areas will be excavated, the pavement widened, and the shoulders stabilized as indicated on the contract plan.

Transverse joints will be cleaned and sealed with various materials in limited areas.

The test sections and the existing concrete payment will be resurfaced with various depths of Asphalt Concrete Item 51MF.

Adequate ramp sections will be built between different thickness of overlay so that the surface profile will be smooth.

The contractor will be allowed to place and compact a 1 inch truing and leveling course over the broken concrete pavement to maintain traffic, with an approved truck towed paver and one 8-10 ton steel wheel roller, so long as the final compacted thickness is as near to the nominal thickness as is practical, the layer fully compacted, and the work done to the satisfaction of the Engineer.

ITEM 04203.9998 BREAKING AND SEATING EXISTING CONCRETE PAVEMENT

DESCRIPTION

Under this item the Contractor shall break and seat the existing concrete pavement within the payment lines shown on the plans or within revised payment lines established in writing by the Engineer prior to performing the work. The pavement shall be broken only as necessary to seat the individual pieces as indicated below.

MATERIALS

None specified.

CONSTRUCTION DETAILS

The Contractor shall break the existing concrete pavement such that the maximum dimension of any unbroken portion of the pavement does not exceed three feet. The method of breaking shall be approved by the Engineer. After the pavement has been broken, it shall be seated by two passes of a roller conforming to the requirements of Section 203-3.13B and weighing fifty (50) tons gross weight.

The work shall be sequenced so that the breaking and seating of existing concrete pavement is completed prior to the construction of shoulders and the installation of underdrain. In conducting his operations, the Contractor shall exercise caution so as not to damage existing structures and utilities. The broken pavement shall be seated on a daily basis immediately following the pavement breaking or as ordered by the E.I.C. Upon completion of breaking and/or seating, the pavement shall be left in adequate condition to carry traffic. Subsequent bottom course pavement construction on this broken and seated foundation shall be placed within two weeks of the completion of the breaking and seating operations.

METHOD OF MEASUREMENT

The quantity shall be the number of lane miles computed from the payment lines shown on the plans or from revised payment lines established by the Engineer in writing prior to performing the work.

BASIS OF PAYMENT

The unit price bid per lane mile shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work including any temporary work or work areas necessary to accommodate turning of the equipment.

ITEM 05203.9997 BREAKING AND SEATING EXISTING CONCRETE PAVEMENT

DESCRIPTION

Under this item the Contractor shall break and seat the existing concrete pavement within the payment lines shown on the plans or within revised payment lines established in writing by the Engineer prior to performing the work. The pavement shall be broken only as necessary to seat the individual pieces as indicated below.

MATERIALS

None specified.

CONSTRUCTION DETAILS

The Contractor shall break the existing concrete pavement such that the maximum dimension of any unbroken portion of the pavement does not exceed six feet. The method of breaking shall be approved by the Engineer. After the pavement has been broken, it shall be seated by two passes of a roller conforming to the requirements of Section 203-3.13B and weighing fifty (50) tons gross weight.

The work shall be sequenced so that the breaking and seating of existing concrete pavement is completed prior to the construction of shoulders and the installation of underdrain. In conducting his operations, the Contractor shall exercise caution so as not to damage existing structures and utilities. The broken pavement shall be seated on a daily basis immediately following the pavement breaking or as ordered by the E.I.C. Upon completion of breaking and/or seating, the pavement shall be left in adequate condition to carry traffic. Subsequent bottom course pavement construction on this broken and seated foundation shall be placed within two weeks of the completion of the breaking and seating operations.

METHOD OF MEASUREMENT

The quantity shall be the number of lane miles computed from the payment lines shown on the plans or from revised payment lines established by the Engineer in writing prior to performing the work.

BASIS OF PAYMENT

The unit bid per lane mile shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work including any temporary work or work areas necessary to accommodate turning of the equipment.

SPECIAL SPECIFICATION

ITEM 08203.9998 Breaking and Seating Old Pavement

DESCRIPTION: Under this Item the Contractor shall break and seat the existing pavement within the limits shown on the plans or designated in the proposal or by the Engineer.

MATERIALS: None.

CONSTRUCTION DETAILS: The Contractor shall break the existing pavement such that the pavement segments have a maximum dimension of seven feet and a minimum dimension of approximately three feet. The method of breaking the pavement and the equipment used shall be subject to the approval of the Engineer. Upon completion of the breaking operation the pavement shall be swept clean of all loose fragments. The pavement shall then be rolled with a pneumatic tired roller or a comparable roller weighing a minimum of twenty (20) tone gross weight as described in subsection 203-3.12 of the Specifications, and approved by the Engineer-in-Charge. Rolling shall be continued until the pieces of pavement are seated in the existing subbase. The period of rolling shall be determined by the Engineer-in-Charge. In conducting his operations, the Contractor shall exercise caution so as not to damage existing structures and utilities.

The work shall be sequenced so that the breaking and seating of the existing pavement at any location is completed before starting to install underdrain or construct new shoulders at that location. During working hours, one-way traffic is to be maintained through the work area unless a detour is required by the contract plans.

Upon completion of breaking, seating, and necessary cleaning, the pavement shall be left in adequate condition to carry two-way traffic and to receive subsequent construction courses. If the use of Asphalt Concrete - Truing and Leveling Course is necessary to meet this requirement, the tons used will be paid for under that Item.

METHOD OF MEASUREMENT: Payment under this Item will be made, at the unit price bid, for the number of square yards of pavement broken and seated in accordance with this specification in the areas as shown on the plans or as revised by the Engineer.

BASIS OF PAYMENT: The unit price bid per square yard of this Item shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work (including any temporary work and work areas necessary to accommodate turning of the equipment). Payment for Asphalt Concrete - Truing and Leveling Course will be made under its appropriate Item.

ITEM 09203.9999 BREAKING AND SEATING EXISTING CONCRETE PAVEMENT

DESCRIPTION

Under this Item the Contractor shall break and seat the existing concrete pavement within the payment lines shown on the plans or within revised payment lines established in writing by the Engineer prior to performing the work. The pavement shall be broken only as necessary to seat the individual pieces as indicated below.

MATERIALS

None specified.

CONSTRUCTION DETAILS

The Contractor shall break the existing concrete pavement such that the maximum dimension of any unbroken portion of the pavement does not exceed seven feet. The method of breaking shall be approved by the Engineer. After the pavement has been broken, it shall be seated by five passes of a roller conforming to the requirements of Section 203-3.13B and weighing fifty (50) tons gross weight.

The work shall be sequenced so that the breaking and seating of existing concrete pavement is completed prior to the construction of shoulders and the installation of underdrain. In conducting his operations, the Contractor shall exercise caution so as not to damage existing structures and utilities. The broken pavement shall be seated on a daily basis immediately following the pavement breaking or as ordered by the E.I.C. Upon completion of breaking and/or seating, the pavement shall be placed within two weeks of the completion of the breaking and seating operations.

METHOD OF MEASUREMENT

The quantity shall be the number of lane miles computed from the payment lines shown on the plans or from revised payment lines established by the Engineer in writing prior to performing the work.

BASIS OF PAYMENT

The unit price bid per lane mile shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work including any temporary work or work areas necessary to accommodate turning of the equipment.

SPECIAL SPECIFICATION

ITEM 18203.99 BREAKING AND SEATING EXISTING CONCRETE PAVEMENT

DESCRIPTION

Under this item the Contractor shall break and seat the existing concrete pavement within the payment lines shown on the plans or within revised payment lines established in writing by the Engineer prior to the placement of a bituminous overlay.

MATERIALS

None Specified.

CONSTRUCTION DETAILS

Before breaking and seating operations begin, the Engineer will designate test sections. The Contractor shall break the test sections using varying impact energies until full depth cracking is established to the satisfaction of the Engineer. This impact energy and the striking pattern later described will then be used for the remainder of the project.

The equipment for breaking the concrete pavement shall be approved by the Engineer and shall be capable of producing the desired breaking without excessive displacement or spalling of the concrete. The Contractor shall break the existing concrete pavement conforming to the following pattern. The existing pavement shall be broken transversely such that adjacent transverse breaks do not exceed 3 feet in the longitudinal direction. The spacing of hammer blows must not exceed 6" transversely across the pavement lane or lanes. The transverse breaking pattern does not need to be in a straight line across each lane, a slightly arc-shaped pattern is acceptable. The impact hammer shall be operated in a manner to produce full depth transverse cracking with a minimum of surface spalling.

After the pavement has been broken, it shall be seated on a daily basis immediately following the pavement breaking or as ordered by the Engineer, The broken pavement shall be seated by two passes of a roller conforming to the requirements of Section 203-3.13B and weighing fifty (50) tons gross weight. If the pavement is opened to traffic after the breaking and seating operation but prior to placement of the first bituminous course, the Contractor shall maintain the pavement for traffic by sweeping, patching, etc., to the satisfaction of the Engineer. Subsequent asphalt concrete bottom course pavement construction on this broken and seated concrete pavement shall be placed within two weeks of the completion of the breaking and seating operation.

The work shall be sequenced so that the breaking and seating of existing concrete pavement is completed prior to the construction of shoulders and the installation of underdrains. In conducting his operations, the Contractor shall exercise caution so as not to damage existing structures and utilities.

METHOD OF MEASUREMENT

The quantity shall be the number of lane miles computed from the payment lines shown on the plans or from revised payment lines established by the Engineer in writing prior to performing the work.

BASIS OF PAYMENT

The unit price bid per lane mile shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work.

SPECIAL SPECIFICATION

ITEM 18203.9901 BREAKING AND SEATING EXISTING CONCRETE PAVEMENT

DESCRIPTION

Under this item the Contractor shall break and seat the existing concrete pavement within the payment lines shown on the plans or within revised payment lines established in writing by the Engineer prior to the placement of a bituminous overlay.

MATERIALS

None Specified.

CONSTRUCTION DETAILS

Before breaking and seating operations begin, the Engineer will designate test sections. The Contractor shall break the test sections using varying impact energies until full depth cracking is established to the satisfaction of the Engineer. This impact energy and the striking pattern later described will then be used for the remainder of the project.

The equipment for breaking the concrete pavement shall be approved by the Engineer and shall be capable of producing the desired breaking without excessive displacement or spalling of the concrete. The Contractor shall break the existing concrete pavement conforming to the following pattern. The existing pavement shall be broken transversely such that adjacent transverse breaks do not exceed 3 feet in the longitudinal direction. The spacing of hammer blows must not exceed 6" transversely across the pavement lane or lanes. For each transverse pass of the breaking machine, the pattern should begin one foot from the shoulder and move to the centerline of the pavement. The transverse breaking pattern does not need to be in a straight line across each lane, a slightly arc-shaped pattern is acceptable. The radius of the arc should be seven feet minimum. The use of one or two arc-shaped breaking patterns to cover one full lane width is acceptable. The impact hammer shall be operated in a manner to produce full depth transverse cracking with a minimum of surface spalling.

After the pavement has been broken, it shall be seated on a daily basis immediately following the pavement breaking or as ordered by the Engineer. The broken pavement shall be seated by two passes of a roller conforming to the requirements of Section 203-3.13B and weighing fifty (50) tons gross weight. If the pavement is opened to traffic after the breaking and seating operation but prior to placement of the first bituminous course, the Contractor shall maintain the pavement for traffic by sweeping, patching, etc., to the satisfaction of the Engineer. Subsequent asphalt concrete bottom course placement construction on this broken and seated concrete pavement shall be placed within two weeks of the completion of the breaking and seating operation.

The work shall be sequenced so that the breaking and seating of existing concrete pavement is completed prior to the construction of shoulders and the installation of underdrains. In conducting his operations, the Contractor shall exercise caution so as not be damage existing structures and utilities.

METHOD MEASUREMENT

The quantity shall be the number of lane miles computed from the payment lines shown on the plans or from revised payment lines established by the Engineer in writing prior to performing the work.

BASIS OF PAYMENT

The unit price bid per lane mile shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work.

ITEM 18502.5050 SAWCUTTING WELDED WIRE MESH
REINFORCEMENT PRIOR TO BREAKING AND SEATING EXISTING CONCRETE PAVEMENT

DESCRIPTION

This item is to be used in conjunction with Item 18203.9902, Breaking and Seating Existing Concrete Pavement. The intent of this specification is to prevent welded wire mesh reinforcement mats located in the upper third of PCC pavement slabs from holding broken and seated pieces of pavement together and forcing them at act as a single unit for more than twenty feet in the longitudinal direction (the direction of travel).

CONSTRUCTION DETAILS

Prior to breaking and seating, the Contractor shall saw cut transverse grooves in the existing PCC pavement slabs at twenty foot intervals between transverse expansion and/or contraction joints. The width of these saw cuts shall be a minimum of 1/10 of an inch and shall extend for the full width of the pavement lane or lanes to be broken and seated. The saw cuts shall be of sufficient depth to insure that the welded wire mesh reinforcement has been cut. If this cannot be readily demonstrated to the satisfaction of the Engineer, the saw cut shall be a minimum of 4 1/2 inches in depth.

METHOD OF MEASUREMENT

This work shall be measured by the number of linear feet of grooves cut.

BASIS OF PAYMENT

The unit price bid per linear foot shall include the cost of all labor, materials and equipment necessary to complete the work specified.

SPECIAL SPECIFICATION

ITEM 18203.9902 CRACKING AND SEATING EXISTING CONCRETE PAVEMENT

Under this item, the Contractor shall crack and seat the existing concrete pavement within the payment lines shown on the plans or within revised payment lines established by the Engineer in writing prior to the placement of a bituminous overlay.

MATERIALS

None Specified.

CONSTRUCTION DETAILS

Before cracking and seating operations begin, the Engineer will designate a test section. The Contractor shall crack the pavement in the test section using varying impact energies until full depth cracking is established to the satisfaction of the Engineer. This impact energy, and the striking pattern later described, will then be used for the remainder of the project. Within the test section, coring will be required to verify that cracks are being established full depth. The Department of Transportation will obtain the necessary cores. The Contractor shall supply water to assist in locating cracks in the concrete pavement. The water shall be applied to the surface in a fine spray. Following cracking and after the surface dries, water remaining in the cracks will readily identify crack location.

The equipment for cracking the concrete pavement shall be approved by the Engineer and shall be capable of producing the desired cracking without excessive displacement or spalling of the concrete. Unguided free-falling weights such as "headache or wrecking balls" will not be permitted to crack the pavement. The Contractor shall crack the existing concrete pavement in conformance with one of the following patterns. Regardless of which pattern or pavement breaker is used, the pavement shall be cracked transversely such that adjacent cracks do not exceed 3 feet in the longitudinal direction.

If a drop hammer is used (approximately 1200 lb. weight with small diameter (5") breaking head), the following pattern shall apply. The spacing between hammer blows shall not exceed 6" moving transversely across the pavement lane or lanes. For each transverse pass of the breaking machine, the pattern shall begin one foot from the shoulder and proceed to the centerline of the pavement. The height of drop of the breaking head shall be adjusted to produce full depth cracking with a minimum of surface spalling.

The transverse cracking pattern is not required to be in a straight line across each lane. A drop hammer which creates a slightly arc-shaped pattern across each lane is acceptable. If such a pavement breaker is used, the following pattern shall apply. The radius of the arc shall be seven feet minimum. Cracking one full lane width using one or two arc-shaped patterns is acceptable, as long as the entire lane is cracked. The pattern shall begin one foot from the shoulder and progress transversely to the centerline, allowing not more than 6" between hammer blows.

If a pavement breaker is used incorporating a 12,000 lb. drop weight (six feet wide), one pass of the pavement breaker down the center of the lane is acceptable, provided cracking is produced across the entire lane width. Pavement cracks radiating from the ends of the drop weight to the pavement edge are acceptable. The height of drop shall be adjusted to produce full depth cracking with a minimum of surface spalling.

Cracking concrete pavement will not be permitted over drainage facilities, utilities, etc. Regardless of which type of equipment is used, provisions shall be made to protect passing traffic from flying debris during the cracking operation.

Following cracking but prior to asphalt patching and overlaying, the pavement shall be seated. The cracked pavement shall be seated by two passes of a roller conforming to the requirements of Section 203-3.13B and weighing fifty (50) tons gross weight. If the pavement is opened to traffic after the cracking and seating operations but prior to placement of the first bituminous course, the Contractor shall maintain the pavement by sweeping, asphalt patching, etc. to the satisfaction of the Engineer.

The sequence of the operations in conjunction with this item shall be performed in the following order: any sawcutting to cut steel mesh reinforcement, cracking, seating, patching with asphalt concrete, tack coat, overlaying. Work shall be sequenced so that the cracking and seating of the concrete pavement is completed prior to the construction of shoulders and the installation of underdrains. In conducting his operations, the Contractor shall avoid cracking over existing drainage structures and utilities.

The Contractor shall schedule his operations so that a minimum of 3 1/2" of asphalt concrete shall be placed over the cracked and seated pavement before paving ceases for the winter. Asphalt concrete shall be placed within two weeks of the completion of the cracking and seating operations. The Contractor can delay placement of the overlay (in the cracking and seating sections) beyond the two week limit if approved by the Engineer and he satisfactorily demonstrates he can maintain traffic safely over the cracked pavement by sweeping and/or patching.

METHOD OF MEASUREMENT

The quantity shall be the number of lane miles computed from the payment lines shown on the plans or from revised payment lines established by the Engineer in writing prior to performing the work.

BASIS OF PAYMENT

The unit price bid per lane mile shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work.

APPENDIX B

Figure B1 - Typical Seating Operation With A 50 Ton Roller

Figure B2 - Typical Coring Operation To Verify Full Depth Cracking

APPENDIX C

Overlay Courses

1. Rte. 60 (D250877)

Variable	Asphalt Concrete Truing And Leveling
3"	Asphalt Concrete Type I Base
2"	Asphalt Concrete Type III Binder
1 1/2"	Asphalt Concrete Type 7F Top

2. Rte. 17 (D250990)

1" min.	Asphalt Concrete Truing And Leveling
2 1/2"	Asphalt Concrete Type III Binder
1 1/2"	Asphalt Concrete Type 6F Top

3. Rte. 15 (D500103)

3"	Asphalt Concrete Type I Base
1 1/2"	Asphalt Concrete Type III Binder
1"	Asphalt Concrete Type 7F Top

4. I81 (D500048)

2" min.	Asphalt Concrete Truing And Leveling
1 1/2"	Asphalt Concrete Type III Binder
1 1/2"	Asphalt Concrete Type 7F Top

5. Rte. 17 (D500183)

- 3"	Asphalt Concrete Truing And Leveling
1 1/2"	Asphalt Concrete Type III Binder
1 1/2"	Asphalt Concrete Type 6F Top

6. I590 (D500049)

Variable	Asphalt Concrete Truing And Leveling
3 1/2"	Asphalt Concrete Type III Binder
1 1/2"	Asphalt Concrete Type 7F Top

7. I84 (D500088)

3"	Asphalt Concrete Type I Base
1 1/2"	Asphalt Concrete Type III Binder
1 1/2"	Asphalt Concrete Type 6F Top

8. Rte. 13 (D251503)

Variable	Asphalt Concrete Truing And Leveling
3 1/2"	Asphalt Concrete Type III Binder
1 1/2"	Asphalt Concrete Type 7F Top

McCarty, William M.
Cracking and Sealing PCC Pavement - Construction Techniques and Overlay Performance. Albany, New York State Dept of Transportation, December 1987, (27p).

DATE	ISSUED TO	Date Returned